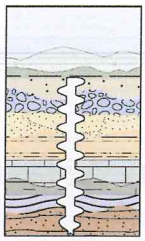

1499 HUNTINGTON DRIVE
SUITE 402
SOUTH PASADENA
CALIFORNIA 91030
GSi /water
(626) 441 - 0039

June 1, 2012

Mr. Brent Gray
Director of Engineering Projects
Mission Springs Water District
66575 Second Street
Desert Hot Springs, CA 92240

OBJECTIVE: GROUND WATER STUDY AND MONITORING FOR MISSION CREEK SUB-BASIN

Dear Mr. Gray,

Pursuant to our telephone conversation on May 25, 2012, GSi/water is pleased to outline a scope of work for additional study in the Mission Creek Sub-basin. The objective is to provide information to help with basin management planning, including the installation of a ground water monitoring network.

Five tasks are proposed to help answer the following questions:

- *How does spreading of Colorado River Aqueduct (CRA) water affect the Mission Creek Sub-basin? What flow pathways does CRA water follow?*

  Task 1: Monitor shallow ground temperatures around Mission Creek Spreading Basin.

- *Where does spreading water go? What is the connection between spreading water and production wells in the Mission Creek Sub-basin?*

  Task 2: Analyze stable isotopes of water to understand extent of Spreading Basin (CRA) water.

- *What are potential water quality impacts **due to spreading** in the Mission Creek Sub-basin? What other water quality trends may be affecting the Mission Creek Sub-basin?*

  Task 3: Update water quality database and geomorphic base map; analyze to identify trends.

- *What additional data would help with integrated basin management planning?*

  Task 4: Identify location(s) for monitoring wells.

  Task 5: Provide geologic oversight during drilling and testing of monitoring wells.

This proposal provides a detailed workplan with specific objectives for each task and an estimated schedule. After reviewing this proposal, should you have any questions, we would be happy to respond. Thank you for your consideration and continued interest in our work.

DISCUSSION

In 2005, GSi/water completed a study of the alluvial ground water basin for the Mission Springs Water District with estimates of recharge rates from contributing catchments and examination of the geologic structures controlling ground water movement. This was a good start to understand how to help manage the Mission Creek Sub-basin. Since that time, artificial recharge of CRA water at the Mission Creek Spreading Basin has increased. One objective of this new scope of work is to investigate the effects of spreading on the Mission Creek Sub-basin – both in terms of quality and quantity.

Thermal Monitoring

It is unknown how the Spreading Basin disperses its water. There may be three possibilities, or some combination thereof:

(1) Shallow Diversion: The spreading water stays shallow as it moves away from the Spreading Basin, encounters the creeks, and continues with topography – mainly along Mission Creek – southward and out of the Mission Creek Sub-basin.

(2) Deep Diversion: The spreading water encounters hidden faults and flows in directions other than those suggested by normal topography.

(3) Deep Infiltration: The spreading water infiltrates to depths such that surface creeks do not impede its flow, allowing it to travel farther eastward than waters diverted by surface creeks.

The thermal method responds to moving ground water. This would include artificial recharge at the Mission Creek Spreading Basin as well as natural recharge of local waters from major catchments.

Our 2005 study included a broad areal thermal survey to identify dominant recharge pathways *of native waters* throughout the Mission Creek Sub-basin and also the other three Sub-basins. The temperature measurements for this survey were recorded in January 2004 – during an extended lull in spreading operations. According to Desert Water Agency (DWA) Engineer's Reports, no CRA water was spread between January 2003 and September 2004. Because a full year without artificial recharge elapsed prior to our thermal survey, the 2004 thermal data provide a good basis of comparison for future measurements.

We propose to repeat our thermal survey, recording measurements monthly for one year, over an area focused around the Spreading Basin. A tighter probe network would provide improved resolution to differentiate natural from artificial recharge and interpret where the water from spreading is going.

Water Quality and Stable Isotopes of Water

Little is known about the effects of spreading on ground water quality in the Mission Creek Sub-basin. It is well-known that CRA water tends to have higher salinity than native ground water. Less understood is how spreading waters may act to mobilize radioisotopes from sedimentary layers, possibly contributing to elevated uranium in the Mission Creek Sub-basin. We would examine water quality data from wells within the Mission Creek Sub-Basin – including those of the District, Coachella Valley Water District (CVWD) and others – to identify any trends with respect to nitrate, salinity and uranium.

To further assist with basin management planning, to investigate the effects of spreading and to trace water from different sources, we propose to collect and analyze stable isotope data. As a tracer, stable isotopes are economical and conservative. In addition to their low cost, stable isotopes are more reliable than other types of tracers (i.e. chemicals – natural or added) because the isotopic signature is a property of the water at a molecular level.

In preparing this proposal, we briefly reviewed existing water quality and stable isotope data from the United States Geological Survey (USGS) and others. These data show CRA waters to be isotopically "lighter" than native ground waters. This distinction provides a good starting point for further investigation. We propose to collect ground water samples from District wells and other strategic sources to characterize the isotopic signature of end-member waters (CRA water, native ground water, geothermal waters) and evaluate mixing of these sources in the Mission Creek Sub-basin.

Ground Water Monitoring and Basin Management Planning

To help improve the knowledge base for basin management planning, GSi/water would use data from previous studies – including work completed as part of this proposal – to help the District identify locations for ground water monitoring wells. Each well would be deep enough to monitor long-term fluctuations in ground water elevation and to allow periodic collection of water quality samples.

Wells would be designed to accommodate submersible pump capable of producing 10 to 15 gallons per minute (gpm) and include an accompanying stilling well or sounding tube. The purpose of the stilling well would be to monitor water levels during aquifer pumping tests to help characterize the aquifer setting.

Data collected during drilling and testing would be used to design monitoring protocol to assist with basin management planning for the Mission Creek Sub-basin.

STATEMENT OF WORK

Task 1: **Update the 2004 Thermal Survey with New Information and Analyses focusing on Area around the Spreading Basin** **$39,500**

The objective would be to identify changes in subsurface ground water flow patterns in response to spreading activities at the Mission Creek Spreading Basin.

For our 2004 thermal survey, 29 probe stations were installed in the area near the Mission Creek Spreading Basin. During a field visit, we unearthed two of the existing probes. It may be possible to uncover others. This proposal assumes 25 probe stations will be established.

To achieve this objective, our work would:

- Re-establish parts of the original probe network and strategically establish additional stations;
- After establishing the thermal monitoring network, monitor temperature monthly for one year;
- From monitoring, identify changes over time in response to spreading activities;
- Using data from our 2004 – 2005 thermal survey as a baseline, analyze thermal data to interpret the dominant ground water flow paths as CRA water infiltrates into the subsurface and moves away from the Spreading Basin.
- Provide three (3) brief quarterly reports to include data analysis and interpretation.
- At the end of one year of monitoring, synthesize findings in a brief year-end summary report, to include findings from final quarterly monitoring.

Task 2: **Evaluate Stable Isotopes of Water to assess the extent of spreading CRA water in the Mission Creek Sub-basin** **$13,500**

The objective would be to characterize end-member waters, such that locally-sourced "native" ground waters can be differentiated from those that have been recharged by imported CRA waters. This would help to assess where the waters from spreading are going and to estimate what proportion reaches throughout Mission Creek Sub-basin.

To achieve this objective, our work would:

- Begin with the compilation of existing stable isotope data for the Mission Creek Sub-basin, including from studies by the USGS and others;
- Establish the natural baseline isotopic signature of native ground waters before spreading operations began;

- Collect up to twenty (20) water samples to characterize the extent of spreading. Sample locations would include wells in the Mission Creek and Desert Hot Springs Sub-basins (including District wells, DWA wells, CVWD wells and privately-owned wells) and CRA water used for artificial recharge at the Mission Creek Spreading Basin;

- Water samples would be sent to the University of Arizona – Environmental Isotope Laboratory for isotopic analysis;

- Analyze data and provide a brief summary report with findings, interpretations and recommendations for continued monitoring.

Task 3: Update water quality database and geomorphic base map $15,600

The objective would be to identify and evaluate any trends – spatial and/or temporal – with respect to nitrate, salinity and uranium. To achieve this objective, our work would:

- Begin by updating our database to include additional water quality data from CVWD wells – and others – in the Mission Creek Sub-basin;

- Update our geomorphic base map with major faults to investigate their relationship to water quality;

- Analyze water quality and geomorphic data for trends;

- Provide a brief summary report with findings, interpretations and recommendations for continued monitoring.

Task 4: Recommend location(s) for future monitoring wells for the Mission Creek Sub-basin Management Plan $3,400

The objective would be to identify locations for up to three (3) ground water monitoring wells to help with basin management planning in the Mission Creek Sub-basin. Each well would have 4-in diameter PVC casing to accommodate a submersible pump capable of producing 10 to 15 gpm. An accompanying 2-in diameter stilling well or sounding tube would be included in the well design. To achieve this objective, our work would:

- Evaluate results from Tasks 1, 2 and 3 – and other studies – to identify target areas for ground water monitoring wells;

- Recommend locations and depths for up to three (3) ground water monitoring wells;

- Assist with the preparation of technical specifications to solicit bids from Drilling Contractors.

- Provide brief letter report with recommended locations.

Task 5: Geologic oversight during drilling and testing of monitoring wells $61,500

The objectives would be to collect and analyze data to help characterize the ground water basin, design the monitoring wells and recommend protocol for continued monitoring. To achieve these objectives, our work would:

- Provide geologic oversight during drilling: collect and describe lithologic samples at 5-ft intervals; collect and analyze formation fluids for field water quality parameters (pH, electrical conductivity, and temperature);
- Provide geologic oversight during geophysical logging. Drilling contractor would provide for standard E-log (Spontaneous Potential; Short- and Long- Normal Resistivity; Lateral Resistivity), Gamma Log and Spectral Gamma Log to characterize the formation around the borehole and identify intervals with elevated radioisotopes.
- Perform down-hole temperature logging in drilled borehole to help characterize the aquifer setting and identify zones with active lateral flow;
- Provide final design for each monitoring well to include screen interval and gravel pack;
- Oversee well construction, to include casing, screen, stilling well tube and gravel pack;
- Design aquifer pumping tests for each well: record production rates and water level data during testing and water level recovery;
- At the end of each pumping test, collect water quality samples for laboratory analyses to include general, mineral, physical and radiological parameters;
- Prepare well completion report for each monitoring well with summary of findings and recommendations for continued monitoring.

GSi/water – Total Estimated Cost $133,500

Additional Subcontractor Cost (Assume 3 wells to 500 ft) $119,000

Additional Subcontractor Cost (Assume 3 wells to 1,000 ft) $234,000

Total Estimated Project Cost: GSi/water + Sub-Contractor (Assume 500 ft) $252,500

SPECIAL COMMENTS

We understand that this work would be funded as part of a Local Groundwater Assistance Grant from the Department of Water Resources. To remain sensitive to the anticipated timeline for grant approval, this proposal will remain in effect for eight (8) months from the date of issuance. We anticipate that we would be able to begin work on this project upon authorization.

We invoice monthly for time-and-materials based on estimated budgets. Payment is due 30 days from the date of the invoice. Upon acceptance of this proposal, we require a retainer fee in the amount of 10% of the approved work. This total is due at the time of contract execution and would be applied toward the first month's invoice.

Should the scope of the project change during its course, we will notify and seek client approval before instituting the change. If the Client cannot be contacted, we will proceed with the best course of action for the project objectives based upon the data available and continue in our attempts to contact the Client.

GSi/water is in its fifty-first year of operation in ground water exploration and development, dam seepage identification and monitoring, and related projects. We provide $1,000,000 in General Liability Insurance, and $1,000,000 Professional Liability Insurance. We follow all Federal, State, and local laws regarding hiring and employment practices.

This proposal has been prepared exclusively for the **Mission Springs Water District.** We request that there be no distribution of any or all parts of this proposal beyond the client and the clients' representatives specific to this project without direct consent from GSi/water. Our policy is for all collected information to remain client-confidential. Any requests for data from outside sources will not be granted without written consent.

We look forward to answering any questions.

Sincerely,
GSi/*water*

_____
Rachel E. Ridgway
GIT 351
Project Geologist
GSi/water

_____
J.H. Birman, PhD
PG 994, CHG 125
President
GSi/water

GROUND WATER STUDY AND MONITORING FOR MISSION CREEK SUB-BASIN

ESTIMATED BASELINE SCHEDULE

MONTH	One				Two				Three				Four				Five				Six				Seven				Eight				Nine				Ten				Eleven				Twelve				Thirteen				Fourteen				Fifteen			
WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Task 1																																																														
Task 2																																																														
Task 3																																																													
Task 4																																																													
Task 5																																																													

- Information Review/Thermal Survey Design
- Monthly Monitoring
- Sample/Data Collection & Laboratory Analysis
- Drilling/Testing Oversight
- Data Analysis/Synthesis/Reporting